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ABSTRACT

A study was conducted to explore how children learn to read in kindergarten. The study employed a heuristic model that included entering ability, home background, instructional processes, home support for literacy development, and measures of student ability at the end of kindergarten. Children were tested, whole-day classroom observations were made, and questionnaires were sent to parents to collect information that could be used to develop data-driven linear structural relationships between variables to explain how children develop reading ability. Results showed that children's performances in reading at the end of kindergarten were directly affected by their knowledge of letters when they enter kindergarten, by their active participation in reading activities at home, and by the amount of phonics instruction and word meaning instruction that they receive in school. (Five tables of data and five figures are included. Twenty-six references are attached. (MG)

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CENTER FOR THE STUDY OF READING

Technical Report No. 515

THE DEVELOPMENT OF READING ABILITY IN KINDERGARTEN

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October 1990

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Abstract

A study was conducted to explore how children learn to read in kindergarten. The study employed a heuristic model that includes entering ability, home background, instructional processes, home support for literacy development, and measures of student ability at the end of kindergarten. Children were tested, whole-day classroom observations were made, and questionnaires were sent to parents in order to collect information that could be used to develop data-driven linear structural relationships between variables to explain how children develop reading ability. Results showed that children's performances in reading at the end of kindergarten are directly affected by their knowledge of letters when they enter kindergarten, by their active participation in reading activities at home, and by the amount of phonics instruction and word meaning instruction that they receive in school. These results are discussed in terms of what parents and teachers can do within these areas to affect reading development directly. An explanation of the formation of two constructs, one for decoding ability and the other for comprehension ability at the end of kindergarten, is also offered.

THE DEVELOPMENT OF READING ABILITY IN KINDERGARTEN

This report presents findings from a study of how children learn to read in kindergarten. The study is part of a longitudinal research project investigating how children learn to comprehend what they read and how they learn science concepts and processes.

Quantitative research on the kindergarten year of schooling recently has focused on the relationship between the length of the kindergarten day and measures of student achievement (Jarvis & Molnar, 1983; Oliver, 1980; Johnson, 1974; Winter & Klein, 1970). In addition, Durkin has studied children who read early (1966), the effects of a comprehensive kindergarten program (1970) and, most recently, typical kindergarten instruction (1987). All of these studies have been reviewed extensively in our previous work (Meyer, Hastings, Wardrop, & Linn, 1989), in which we reported that characteristics of instruction in kindergartens, and not the length of the school day, are the best predictors of student achievement at the end of kindergarten. It is our belief that we will understand the learning process more fully by doing research that takes into account the major factors affecting students' lives, while at the same time looking carefully at what teachers do during instruction, as we did in Meyer, et al. (1989). Our previous work focused on understanding the effects of teachers' uses of instructional time, frequency and type of instructional interactions, and feedback to students after their responses. The study described in this report extends those analyses.

This study differs from previous research because it began with the development of a general heuristic model of reading development (Meyer, Linn, Mayberry, & Hastings, 1985) that was intended to encompass the major aspects of young children's lives that logically would contribute to their reading development. The development of the heuristic model provided the framework to guide data collection, and ultimately the initial structural model for kindergarten reading.

Heuristic Model of Reading Development in Kindergarten

The simplest way to think about reading development is to view it as a function of students' abilities as they enter a grade. That is, students' reading performance at the end of each grade reflects their performance at the beginning of that grade. Somewhat more complex models view reading performance as a reflection of students' entry characteristics with some continuing influence from their home backgrounds and parental resources. Even more complex models view reading development as reflecting immediate and changing conditions, such as the stimulation provided by parents in the home, by teachers in schools, and eventually by the students themselves through the reading they do, the television programs they watch, and the activities they choose. We believe that this more complex model, which includes measures of student ability along with measures of home and school influences more accurately depicts the nature of reading comprehension development. That is, reading comprehension development is the result not only of student ability and prior opportunity to learn, but also of immediate school and home support for its development. Figure 1 illustrates these relationships.

[Insert Figure 1 about here.]

Given this model, how should student ability, home support, and school instruction be characterized? What activities at home or school might plausibly lead to the development of reading comprehension ability? While student ability might be expected to be the major influence on reading development, other direct influences, particularly in the early grades, might well include home support and school instruction. Activities at home and in school might be expected to interact with student aptitude to influence reading comprehension. Student-initiated activities such as independent reading might be anticipated to influence reading comprehension performance in later grades, but not in kindergarten, the focus of this report. What follows is a discussion of how we conceptualized key home and school influences on student ability.

Home Influences on Student Ability

Home background. What are the characteristics in children's home backgrounds that are most likely to influence their general ability as they enter kindergarten? One could imagine that parents' occupational status and levels of education would influence children's general ability by the time they begin school, as these characteristics more than others determine who the parents are and what they bring to the home environment. Likewise, the family constellation, the number of adults in the home, as well as the number of older and younger siblings, may influence children's abilities. Finally, the number of hours parents work each week may affect children's entering abilities, especially because parents are removed from home, and therefore their children, when they work.

Home support. What home activities support children's reading comprehension development over time? We believe that there are several clusters of variables that comprise a latent trait of home support activities. Generally, these variables most often fall into categories that represent (a) parents reading to their children; (b) children reading; (c) resources provided, such as books, magazines, and other materials parents give to their children; (d) parental support, those general activities that parents can engage in such as listening to their children; and (e) parental instruction, interactions parents can have as they actually teach young children letter sounds, letter names, or words.

School Influences on Student Ability

What characteristics of instruction may contribute to children's reading comprehension development? We had to make numerous choices in order to develop constructs of beginning reading instruction. In addition, we chose to study three major dimensions of textbooks: their decoding characteristics, because of previous research on the relationship between content coverage and student performance; comprehension characteristics, because of the long research tradition of studies in the process product tradition that have looked at global measures of decoding and comprehension instruction; and "comprehensibility," because of the numerous reports criticizing the quality of stories in lower elementary grade basal reading programs. The conceptualization and measurement methods we used for teaching and instructional materials are presented next.

Teaching. We separated teaching into five constructs: (a) time in activities related to literacy development, (b) decoding activities, (c) comprehension activities, (d) academic feedback to students, and (e) teachers' management styles. Instruction is separate from management because of our belief that teachers do not necessarily manage their classrooms in the same ways that they teach, and because we wanted to be able to look separately at the impact of decoding and comprehension activities. The management style construct captures teachers' strategies for molding children's general behavior by using praise and critical statements to individual students or classes whereas the other latent traits focus on teachers' frequencies and types of instructional interactions. There are numerous feedback categories as well. The characteristics of management style are supported by research findings for general classroom management particularly in the work of Brophy (1983). The time, decoding, comprehension, and feedback variables are extensions of characteristics reported in research on general teaching effects.

Materials. Our analyses of basal reading textbooks completed for this study focused on what is in the textbooks (contents), how the books and text are used (style), and "comprehensibility," the number of problems in the stories. An additional dimension of materials we measured is coverage, the amount of the textbook actually covered by whole classes or instructional groups during reading instruction.

We measured "contents" by counting the number of words presented in the textbooks at each grade level. Both vocabulary words presented in lists and words in connected text were counted. Style was derived from the number of consonant sounds, vowel sounds, names, rules, rhyming, and blending exercises in each lesson. Comprehension questions in the basal reader were divided into those that were explicit or implicit at the word, sentence, or picture level. In addition, summary, background knowledge,

prediction, and opinion questions were counted as well. Questions were then grouped to reflect the percentage of questions that were text-tied (see Meyer, Greer, & Crummey, 1987, or Meyer, Greer, Crummey, & Boyer, 1986, for these full analyses).

We measured "comprehensibility" by employing the categories developed in 1984 by Beck, McKeown, Omanson, and Pople to determine the number of distant referents, story segments in which children are likely to have lack of requisite background knowledge to understand the content, and unclear relationships between events. These analyses were completed upon stories matched for type, length, and number of characters as well as for unmatched selections for each publisher.

Management style. Management style is composed of six classroom process variables. It encompasses the number of times teachers praise children individually or as a class with general behavioral comments such as, "good job," or "I like the way everyone is working hard now." Teachers' critical statements to individuals or classes are tallied in the same way. Each of these is considered to be a general management statement instead of an instructional interaction. These tallies are running totals for each of these four categories from entire school days. They are not therefore separated by activity. Whenever teachers work with less than their entire classrooms "sweep" data are collected. These are percentages of children on task at five-minute intervals. Observers sweep the entire classroom every five minutes and simply count the number of children off task and then calculate the percentage on task at each sweep. The final management style characteristic, frequency of seatwork given, is derived from the total number of sweeps per day. Since a sweep takes place every five minutes, when teachers work with less than entire classes, the total number of sweeps times five represents the minutes spent in independent seatwork activities.

Instructional style. Fourteen additional classroom process variables compose the latent traits decoding interactions, comprehension interactions, and feedback. Taken together, these three latent traits represent instructional style in contrast to management style. Decoding interactions are composed of letter-sound, whole word, sounding out, and blending interactions. Whole word interactions are those in which a teacher asks a child or group to read an entire word. Sounding out interactions are those for which teachers ask children simply to sound out words. Blending interactions have children blend sounds together as when a teacher asks a child to say the sounds in the word *am*, for example. In this instance, a correct student response would be "aaammm." Word reading interactions were also considered part of decoding interactions.

Silent reading interactions are believed to be related to both decoding and comprehension. A teacher is tallied as having had a silent reading interaction after asking a child to read a paragraph, or more, silently. Four additional types of interactions feed exclusively into comprehension interactions. Background knowledge interactions are those that require children to answer questions from what they already know about a topic. These questions are answered from information already in the children's heads. Word comprehension interactions, on the other hand, are those in which the teacher asks a child the meaning of a word after the child has read the word in context. Sentence comprehension interactions are coded as either explicit or implicit. Children read sentences aloud and then if the teacher asks a question that was answered directly from information in the sentence, that interaction is coded as a sentence comprehension text-explicit interaction. If the question was not answered explicitly in the sentence but implicitly instead, that interaction would be coded as sentence comprehension text-implicit.

Six types of sustained feedback also appear in the initial instructional model of reading development at the kindergarten level. Collectively, these may be considered sustained feedback because in each case the teacher continues to interact with the child or group of children until the correct response is given. Repeating a question confirms a child's response and praises an answer. Teachers encourage when they suggest that a child try again or phrase their answers somewhat differently. Teachers lead when they go through a process with children. This process might involve the teacher directing the child to re-read

a sentence and then the teacher asking questions focusing the child on different parts of the sentence until the child can give a correct answer. A teacher might ask for an explanation if he or she judges that the child's answer is not quite clear. Teachers are coded as asking for an explanation after saying something such as, "Tell me more about where Jerry went." Re-examine sustained feedback is coded when saying to a child, "Take another look at that sentence and then think again about when Lilly and Matt got home."

In summary, our generic heuristic model of reading development was composed of eight constructs: home background characteristics, students' ability at the time they began school, the characteristics of the instructional materials used to teach reading, classroom teachers' management and instructional styles, home support for literacy development, independent reading, and students' ability at the end of kindergarten. The question is how do these constructs contribute to the development of children's reading comprehension development? The next section of this report presents a description of the methods we used to answer this question.

Methods

School Districts Studies

Three school districts in the midwest participated fully in this research in that all of their students, parents, and teachers at designated grade levels took part. In two of the districts, all students participate in the study. Each of these districts has a single elementary school. These districts were selected because of the natural variation they provide in educational philosophy, instructional approach, and instructional materials. In this report we will show how these differences in philosophy and approach are reflected in differences in time for reading instruction in kindergarten and other instructional characteristics of instructional style for teaching beginning reading.

District A. This district is in a somewhat self-contained small town. The school studied in this district has a fairly homogeneous student body of children who have mixed ability upon entering kindergarten. There are approximately 80 children in four classes. This district is known for its high student achievement in reading, particularly in the very early grades. The district's educational philosophy includes whole class instruction in all subjects beginning with an academic kindergarten that is characterized by a high percentage of time spent in teacher-directed reading instruction. Teachers in District A almost never group children for instruction because district policy is that all students at a grade level will cover the same content each year. Regular classroom teachers in this district maintain primary responsibility for children with special needs in their classes. Some of these teachers often gear many of their instructional interactions and feedback to their lower-performing students. Kindergarten teachers use the *Alpha K Time* (Reiss & Friedman, 1976) program for beginning reading instruction and then introduce Houghton Mifflin's *Getting Ready to Read* (Durr & Hillerich, 1981) at mid year. They also provide reading instruction for some children in three preprimers.

District B. This district is in a small midwestern town a short drive from a larger town to which many of its citizens commute to work. The school participating in our study from this district has about 150 children per grade level. The district has a tradition of average student achievement in reading in the lower elementary grades, higher achievement in reading in the middle grades, and better-than-average performance in science in the lower elementary grades. Teachers in District B begin grouping for reading instruction in kindergarten, and this practice continues through all of the lower elementary grades. Classes are divided into as many as five or six groups for reading instruction in kindergarten. Thus, students in these classes average considerable time each day doing independent work.

The Harcourt Brace Jovanovich reading program is used by all teachers in kindergarten in District B. Typically, teachers organize a variety of learning centers set up at tables. They then introduce their classes to activities at these centers on Mondays and meet with an average of two groups per day for

teacher-directed instruction. Therefore, each day, even from the beginning of kindergarten, children are in independent groups for some center work and with the teacher for a short period of time as well. The year that this study was conducted was the first year all teachers districtwide were to use the Harcourt Brace programs with every child, even in kindergarten. While teachers had some latitude for when and precisely how they used the program, it was clear that they were all to be providing similar instruction from the curriculum.

District C. This district is located in a suburb of a major city. The school participating in our study from this district has many characteristics of an urban school. It has a very heterogeneous student population. These children are of mixed socioeconomic and ethnic backgrounds. White, Black, and Hispanic children make up this portion of the sample. About 40% of the children are black, 20% are Hispanic, and the rest are white. There are approximately 85 children in three "classes," which are grouped into self-contained kindergartens. Special teachers play a very important role in this school in District C. Bilingual instruction begins in kindergarten for children whose parents choose it. These children are pulled out of their regular classrooms for about half an hour each morning and again each afternoon. No basal reading materials are used in any of the kindergartens. In fact, even after we carefully monitored the reading vocabulary introduced by the three kindergarten teachers, we found no common reading vocabulary words for the classes.

As these short descriptions reveal, there is substantial natural variation among these districts. We believe that each of these districts is fairly typical of numerous school districts in the United States. We will present data on each district separately in the descriptive sections of this report in order to illustrate between-district differences on a number of variables. Analyses that result in linear structural relations models will be developed using the entire sample of teachers and students.

Measures

Standardized Measures of Performance

While the primary thrust of our research is to account for variance in children's reading development, we believed that a certain level of verbal competence was necessary for children to learn beginning reading decoding and comprehension skills. Therefore, we included several measures of verbal-reading performance in our models. Several of these are standardized tests of verbal-reading performance that have been nationally normed.

Wide Range Achievement Test. We administered the reading subtest, Level I of the Wide Range Achievement Test (WRAT) (Jastak, Jastak, & Bijou, 1978) both in the fall and spring of kindergarten. Items on the WRAT reading subtest consist primarily of a series of increasingly difficult words which children read aloud to an examiner. The measure is individually administered and has a stopping rule whereby 12 consecutive errors terminate administration. Fall WRAT scores were used as manifest variables of the latent variable Reading Ability Beginning Kindergarten.

Woodcock Reading Mastery Test. Like the WRAT reading subtest, the Reading Comprehension Passages subtest of the Woodcock test (Woodcock, 1973) was administered in the spring of kindergarten. The basic format of this test consists of increasingly difficult cloze passages children read. This measure is also individually administered and a stopping rule based on 5 consecutive errors is used to terminate administration. Like the WRAT, the Woodcock was used as an observable measure of the latent variable Reading Ability.

CIRCUS Listening Test. The first of the CIRCUS listening tests, Listen to the Story (Educational Testing Service, 1976) was administered in October of the kindergarten year. The next level of the same instrument was administered in the spring of that same year. Each test presents a simple story.

Children listen to the examiner read and then mark pictures that answer questions raised about the story.

California Achievement Test. The reading subtest of the California Achievement Test (CAT) (CTB/McGraw-Hill, 1973) was administered to all children in the spring of their kindergarten year. This subtest was selected because one of the participating districts routinely administered this test and because we felt it was important to include a norm-referenced reading test at the kindergarten level.

Stanford Achievement Test. The reading subtest of the Stanford Achievement Test (SAT) (Madden et al., 1982) was also administered at the end of kindergarten. This subtest was also routinely administered in a district participating in the study. It is a traditional measure of children's abilities to select words after they have been given a beginning sound.

Customized Measures of Verbal Performance and Reading Comprehension

Because we believed that standardized measures of verbal and reading performance do not measure exactly all of the latent traits that we wished to study, we also created our own tests in which verbal and reading performance could be manifested, and we modified tests developed by other researchers.

The Language and Problem Solving Battery. Mason and Meyer developed the Language and Problem Solving Battery (1983) for a longitudinal study of reading comprehension. The Analogies Subtest of that battery was used as a manifest measure of children's entering kindergarten verbal ability.

Chicago Reading Test. The Chicago Reading Test (Barr, 1983) was given during the winter of the kindergarten year and serves as a manifest variable for beginning kindergarten verbal performance. The Chicago tests children on consonant sounds, vowels, and word endings, word families (e.g., *cat*, *fat*, . . . *nat*), and nonsense words (e.g., *fon*).

Observation System to Measure Reading Instruction

What do teachers do that mediates how well children learn to read? To address this question, we designed an observation system to measure numerous aspects of classroom instruction. We were primarily concerned with how teachers allocated time during their school days and what they did during the periods of time that they designated as related to literacy. Therefore, the observation system was designed so that observers kept track of when each activity began and ended, and within those periods, they recorded every instructional interaction the teacher made. It was our belief that the different kinds of statements and questions teachers made gave students different kinds of tasks to perform and that those various kinds of tasks reflected different characteristics of teaching. For example a teacher can print the word GIRL on the chalkboard, but this simple activity gives no hint as to what task is required of the students. It is only when the teacher next says, "John, what word is that?" or "Tommy, sound out that word," or "Alice, tell me the names of the letters in that word," that the task is clear. In this example, the first task is a whole word exercise, the second is a blending task, and the third is a letter-name activity. Our measure of reading instruction allows us to code each of these tasks in a unique way and then examine the teachers' sequences as well as their frequencies of various kinds of activities.

Questionnaires

Home background measures. What indices describe the characteristics in these children's home backgrounds that may predict their reading ability? The measures of home background that appear in Table 3 represent a construct that encompasses education, occupation, hours worked weekly, and the family's constellation in terms of the number of adults and the number of older and younger siblings. The Treiman (1977) scale was used to quantify mother's and father's occupations.

[Insert Table 3 about here.]

Data about children's home backgrounds that focus upon such things as the number of hours each parent works, the parents' educational levels, and the kind of work they do were collected from questionnaires completed by parents. Additional questions focus on the number of adults at home and the number of older and younger siblings the child in the study has. The questionnaire return rate averaged over 83%. We also asked several questions of parents about the amount of homework children have and the role parents take as their children complete their homework.

Home support indices. At the kindergarten level, we used six indices to measure home support activities: (a) parents reading to children, (b) children participating in reading at home, (c) parental resources, (d) parental support, (e) parental instruction, and (f) amount of homework.

Procedures

Ability: Time 0

This point in our heuristic model always represents the beginning of the school year. We selected three measures to represent student ability during the first weeks of kindergarten: (a) the Mason Language and Problem-Solving Battery, (b) a listening comprehension test, and (c) the decoding subtest of the WRAT.

Student ability. Our language battery includes six measures of picture recognition and description; the completion of a series of analogies; the statement repetition subtest of the (WPPSI) Wechsler Preschool and Primary Scale of Intelligence (1967); groups of items to classify; pictures to describe in a sequence; and the recognition and explanation of absurd combinations in a set of pictures (a snowman on a summer beach for example). The analogical reasoning items in our battery fall into three categories: those that ask students to complete a statement that describes a part-whole relationship such as "A person has eyes, a house has a _____;" those that children complete on the basis of identifying categories as in, "A drum is a musical instrument, a necklace is a _____;" and items that require the child to identify a characteristic such as, "An inch is short, a mile is _____." The decoding subtest of the WRAT includes letters to match and identify and words for children to read aloud to an examiner.

We assessed listening comprehension with the CIRCUS--Listen to the Story test administered in October of the kindergarten year. About 60% of these items were identified by the test developers as measuring "comprehension" and the remaining items were labeled as measuring "interpretation." A typical comprehension item is one such as that shown in Figure 2.

[Insert Figure 2 about here.]

Interpretation items require children to figure out a response after hearing a short portion of a story. A typical interpretation item appears as Figure 3. Only the analogies subtest, the decoding subtest of the WRAT, and the composite score from the CIRCUS--Listen to the Story test were found to have promising psychometric properties. Subsequently, these measures were used in the analyses. Total scores from these three instruments compose the latent trait entering ability at the beginning of kindergarten. A fourth test, the Chicago Reading Test, was administered in December of the children's kindergarten year. This is a test of letter sounds, word endings, word families, and random words.

[Insert Figure 3 about here.]

Each kindergarten teacher was observed for nine full days. Observations were scheduled from mid-September through mid-April at approximately three-week intervals during the school year. Time spent

in all literacy-related activities and each instructional interaction during that time were coded at the individual or class level, dependent upon how the teacher delivered it. For example, if a teacher called on an individual child, only that child was credited with that interaction. If, however, the teacher asked a question of the entire class, each child in the class received credit for the interaction. Feedback teachers gave was coded at the same level as the instructional interactions.

Ability: Time 1

This point in our model represents the end of the school year. Various measures were used to assess reading development in the fall and then again in the spring. In kindergarten, letter and word recognition ability was measured consistently on the decoding subtest of the WRAT and on the Reading Comprehension Passages from the Woodcock test. Each of these instruments is administered individually. They both have stopping criteria which also make them particularly appropriate for use with young children. In addition, in the mid-kindergarten year we administered the Chicago Test as another individually administered measure of letter sounds, word endings, word families, and random words. The word reading subtests from the CAT and SAT completed the spring kindergarten reading test battery.

Description of Findings

Instruction

Collectively, these data are intended to present a snapshot of reading instruction for the sample as well as for each district participating in the longitudinal study. Each calculation is at the child level. In other words, the average child in the sample received just under 20 instructional interactions for letter sounds on any given day she or he was observed. Children in District A, however, received almost 50 letter-sound interactions, whereas children in District B averaged just over 10 of these interactions, and children in District C averaged less than 7. The pattern described for letter-sound interactions is typical of each of the seven types of instructional interactions and feedback presented in Table 2. District A children received two to three times as many interactions of each type as did children in the other two districts.

Differences between districts were even more dramatic for time spent decoding without a text and for reading with a text. District A students averaged almost 3 minutes a day decoding without a text and over 3.5 minutes reading with a text, whereas children in the other two districts had zero minutes in these two activities during their 9 observations.

Teachers' management strategies were coded for entire school days independent of instructional activity. In these frequencies, District A teachers had the highest percentage of their students on task throughout the school day, over 87%. This means that over 87% of the students in District A were doing what they were supposed to be doing during each 5-minute interval when observers swept while teachers worked with less than entire classes. District A teachers also spent the least time working with less than entire classes and therefore had the lowest average number of sweeps on any given observation day. District C teachers had the highest rates of praise and criticism statements to children.

Home Background

Results from the home background measures show mothers and fathers in the study generally have junior college educations although there is some variance in the sample and in each of the sites. The parents of District C children averaged some education beyond college. The greatest variance on most of these measures is in District C. Treiman occupational scores in the 40's show generally that fathers of children in this sample tend to be businessmen who are often in managerial positions. Homemakers were scored 40. Legal secretaries were scored 50, and therefore we see that while most mothers'

occupations cluster around their being homemakers in the sample in Districts A and B, mothers in District C are again an exception.

In all districts older siblings averaged one per family while younger siblings averaged about half a sibling per family. There were very close to two adults at home in each family, although there were more than two on the average in District C. Mothers of District A children worked the least, and mothers of District C children worked the most whereas almost the reverse was true for fathers.

Home Support

The specific indicators of home support activities that might contribute to the development of children's reading comprehension differed somewhat from one year to the next. An interesting split between high responses for District A and District C is apparent in Table 4.

Parents of District A students reported the most child participation in reading (children reading to parents and trying to engage them in reading activities), greatest amount of support such as sitting with their child as she or he reads, and the greatest amount of homework. Parents of District C children, on the other hand, reported that they spent the most time reading to their children, almost daily. They also provided the most resources, books, magazines, and games related to literacy. Parents of District C children also claimed that they provided the most instruction to their children. (Instruction items on the questionnaire included parents asking children to sound out words they did not know and asking children comprehension questions as they read.) The homework question focused on the frequency with which children brought home schoolwork.

[Insert Table 4 about here.]

Correlational Results

Table 5 presents correlations of all kindergarten variables: measures of student ability, parental background, home support for literacy development, and the classroom process variables used in either the initial or final structural model for kindergarten. The first five columns represent the parent questionnaire indices. There are surprisingly few high correlations between the parent indices and other measures. Parents reading correlates most strongly with children participating, parental instruction, and mother's education. Children participating, however, correlates moderately with parental instruction, amount of homework, and with the children's WRAT, Chicago, CAT, SAT, and Woodcock scores. Parental support correlates .60 with amount of homework and negatively (-.21) with mother's education. Parental instruction produces low to moderate correlations with all of the achievement measures. The achievement measures generally have high correlations with each other and with each parent's education and occupation. Of particular interest are the high correlations for the individually administered decoding (WRAT and Chicago) and comprehension (Woodcock) measures. Correlations for the classroom process variables show strong relationships between teachers' frequencies of letter interactions, oral reading with comprehension, and feedback labeled collectively as "chunks," seatwork, time decoding with text, and the other classroom process variables. These correlations illustrate the highly collinear relationships that often exist between sets of variables that form constructs such as decoding ability or decoding instruction.

[Insert Table 5 about here.]

Structural Modeling of Reading Comprehension Attainment

In our attempts to account for students' reading achievement at the end of each school year, we employed structural equation modeling using Joreskog's (1978) Linear Structural Relations (LISREL) model. Analyses were performed using the LISREL VI computer package (Joreskog & Sorbom, 1984).

The following paragraphs provide a brief overview of the LISREL approach (for a more detailed discussion, see Joreskog & Sorbom, 1984).

The LISREL model incorporates two components: a structural equations model and a measurement model. The structural equations model, like the more familiar path analysis approach, seeks to estimate structural (path) coefficients for a hypothesized model of the relationships among constructs or variables; the measurement model uses confirmatory factor analysis techniques to accommodate the use of multiple indicators for the latent variables (constructs) of interest, and to take into account measurement errors and specific variables (in the factor analytic sense) of the observed variables.

Although several statistical methods are available for estimating parameters in the model, we used the maximum likelihood procedure which provides a chi-square index of goodness of model fit, t-statistics for the significance of individual parameter estimates, and modification indices suggesting how much improvement in fit could be obtained by relaxing the various constraints (see below) specified in the current version of a model.

In implementing LISREL modeling, we applied three criteria for deciding when the fit of model to data was acceptable. None of the three is a rigorous statistical significance test, but the combination of indices of fit is thought to provide a reasonably balanced approach to judging model adequacy. One outcome of a LISREL analysis using maximum likelihood estimation of model parameters is a chi-square statistic. Because it is sensitive to sample size and to departures from the theoretical multivariate normal distribution of the data, this statistic is not used for making significance tests in the traditional way. Rather, examining the ratio of the chi-square fit statistic to its degrees of freedom is seen as an appropriate index of model adequacy. Recommended ratios range from as small as 1.5 to as large as 5. Because of the complexity of our models and the large number of variables involved, we chose a chi-square/degrees of freedom ratio of 2.5 as our target.

A second indicator of model fit is the "goodness-of-fit" statistic (GFI), which can range from 0.0 to 1.0. (In practice, the GFI may exceed 1.0 under some conditions, but for our purposes, the 0 - 1 approximation seems acceptable.) For these analyses, our target was a GFI greater than .80, although we hoped for values closer to .90.

The third indicator we considered was the root-mean-squared-residual (RMSR) value from the correlation matrix. This quantity is more difficult to interpret, depending in part on the magnitude of the original correlations in the matrix to be analyzed. Based on previous experience with models only slightly less complex than those analyzed here, we specified a value of .70. These choices of criteria are all somewhat arbitrary, but this particular combination seems to represent a reasonable standard that avoids excessive "overfitting" to the unique characteristics of the sample and yet results in models that are theoretically and aesthetically satisfactory.

Within the LISREL approach, there are three kinds of model parameters: free parameters that are to be estimated from the data; constrained parameters, in which two or more estimates must be equal to each other; and fixed parameters whose values are prespecified. In the analyses reported here, structural parameters were either free (estimated based on observed relationships among variables) or fixed equal to zero (representing the absence of a path between two variables). Measurement model parameters were free, when coefficients corresponding to factor loadings were to be estimated from the observed correlations; fixed equal to zero, when some observed variables were required not to be related to particular latent variables; or fixed equal to one, when a single indicator was used or when an indicator was chosen to determine the scale on which latent variables were to be expressed. In a few instances, we fixed a measurement parameter at some value between zero and one, equal to the square root of the estimated reliability of a measure.

General Considerations Relating to Characteristics of the Data

Before considering the results of our modeling efforts, it will be helpful to review some of the considerations that guided our work. We began with the entire set of data that had been collected previously. Obviously, in a study of this magnitude some missing data are inevitable, and in some instances blocks of data for groups of students. (For example, one kindergarten teacher removed the identification labels from students' home questionnaires, so that those responses could never be associated with individuals in the sample.) To maintain a reasonable sample size, we chose to use all available data in these analyses, so that there were differences from variable to variable in how many and which students provided the data. For this reason, all the LISREL analyses described below use correlation matrices instead of the covariance matrices that are ordinarily preferred.

Univariate Distributions

For some variables, examination of the univariate and bivariate distributions revealed that the data were badly skewed in the positive direction, so that a transformation (logarithmic or, usually, square root) was needed. This effect was consistently observed with the variables indexing teachers' use of praise and criticism, and with some of the feedback and interaction variables from classroom observations.

Multicollinearity

In addition, because of the substantial multicollinearity among some variables (especially those involving teachers' classroom behaviors), the initial correlation matrices were invariably near-singular. It was possible to identify pairs or larger subsets of variables whose intercorrelations were substantially responsible for this multicollinearity and to create simple summed composites that were meaningful. Using these composites instead of the separate highly correlated variables partially solved the collinearity problem. It was also necessary to use extreme caution in the specification of initial estimates for the parameters in order to avoid "impossible" solutions.

As we proceeded through the series of analyses at each grade level, we explored several alternative approaches to specifying the relationships among the classroom variables (invariably the most difficult components to model, because the pattern of their intercorrelations with one another was usually inconsistent with their patterns of intercorrelations with the test data). We have not included details of these intermediate analyses and the models associated with them.

Reading a Structural Diagram

There are several "conventions" used in representing structural models schematically. First observed variables are portrayed by rectangles, latent variables (constructs) by circles. In addition, in several of the models described here, we have used a "rectangle" with rounded corners to represent a latent variable based on a single observed variable. This corresponds to the "true-score" for a variable in classical test theory, and the proportion of observed variance for the variable that is considered true-score variance is the complement of the error variance given in the diagram.

The measurement models for exogenous and endogenous variables are indicated by the lighter straight arrows linking observed variables (rectangles) to the latent constructs (circles) for which they serve as indicators. In the case of single indicator components with no measurement error, we have simply used the rectangle representing that observed variable. In these cases, the variables is being treated as an "error-free" measure. Some observed characteristics are more strongly related (or less strongly related) than would be expected based on the factor structure represented in the measurement model. When such relationships occur, they can be modeled by allowing the "measurement errors" to correlate. Few of these correlated errors are shown in the figures, but they are summarized in tabular form.

Possible causal relationships among constructs (the structural model) are indicated by heavier straight lines with single arrowheads, the arrow leading from the antecedent to the consequent variable. For every endogenous variable in a model, the structural relationships account for some proportion of the variance, and some unexplained, or residual, variance remains. Residual variances are represented by numbers at the end of curved arrows leading into the circle representing each endogenous construct. In some instances, two constructs were expected to be more strongly related than could be accounted for by the hypothesized (or obtained) structure. In these cases, the models incorporate covariation among the residuals (unexplained components) of those constructs. Such covariations are represented by curved, double-headed arrows between two residual variances.

We began the analysis of kindergarten data with 49 variables. Because many of the variables were highly interdependent (correlations above .85) and because pairwise deletion was used for missing observations, the correlation matrix based on those variables was ill-conditioned (determinant not detectably different from zero). In order to proceed, we chose to delete some variables from highly collinear subsets and to form simple algebraic sums of others. We then began LISREL modeling with the remaining variables, using the model presented as Figure 4, with appropriate modifications to accommodate these pre-analysis changes.

[Insert Figure 4 about here.]

At each stage of the analysis, we examined t values (critical ratio statistics) to determine which paths might reasonably be deleted from the model; modification indices, indicating approximate reductions in chi-square that would result from adding paths to the model; and patterns of normalized residuals, identifying components of the model where misspecification was most severe. Based on examination and interpretation of these diagnostic results, we revised the model in what appeared to be the most parsimonious way to enhance its accuracy as a representation of the observed relationships. That is, we chose to modify the parameters representing factor structure in the measurement models or "causal" structure in the structural model before introducing correlations among uniquenesses ("measurement errors") in the measurement models or among residuals ("errors of estimate") in the structural model.

The 30 remaining variables and their relationships that resulted from this series of model testing and model revision analyses are portrayed in Figure 5. The following sections describe the various components of this model and the relationships they represent.

[Insert Figure 5 about here.]

Measurement Model Components

How the 30 variables retained in the kindergarten model were clustered into composites or left to stand as single indicators of relevant characteristics is summarized in the following paragraphs. In each case, details about the size of the loadings of each variable on its composite, or the reliability of a single-indicator variable, can be found in Figure 5. Structural and measurement coefficients reported in the figure are standardized coefficients, while the variances of both measurement errors ("uniquenesses") and errors of estimate (residuals) are taken directly as the maximum likelihood estimates derived from the analysis of the correlation matrix.

Home background indicators. Variables in this category represent relatively stable characteristics associated with students home environments, unaffected by other variables for which we have data. They are therefore considered "exogenous" variables. Four of the home background variables--Mother's Education, Mother's Occupation, Father's Education, and Father's Occupation--collectively represent what we have called Home Background. The education measures dominate this latent variable. (It seemed reasonable to specify correlations between the unique components of education and occupation for each parent, recognizing that occupational access depends in part on educational level. This

relationship appears to hold for fathers, less clearly for mothers, in this sample of parents.) Three other home characteristics--Number of Older Siblings, Number of Younger Siblings, and Hours Mother Works per Week--had significant effects on other components of the model, but were not parts of any composite latent variable.

Home support variables. This group of measures represents characteristics of the home environment that are relatively transitory and may change in meaningful ways from year to year. Data were obtained every spring about these characteristics. The five variables retained in the final kindergarten model represent two composites: Home Support for Schooling, a combination of the index of Parental Support and the index of Amount of Homework; and Home Instructional Activities, a combination of the indices of Child's Participation in Reading, Parents Instructing Child, and Parents Reading to Child. Each of these home-support composites was originally conceived as being affected by home background characteristics. Effects that survived the statistical screening are shown in Figure 5.

Classroom observation variables. Our initial model for the classroom observations was admittedly crude, based on ignorance about which behaviors and activities would cluster into meaningful composites. For this reason, the four latent variables on the right side of Figure 5 bear little resemblance to the original representation in Figure 4. One of these variables, Word Comprehension Interactions, resulted from partitioning a single observed variable into true-score and measurement error components. The other three are truly composites consisting of 2-5 observed variables each. Activities Supporting Reading consists of two types of teacher feedback (Teacher Encourages and Asks Explanation), observed interactions focusing on background knowledge, and amount of time spent reading in texts. The Teaching Decoding composite is defined primarily by Letters, itself an additive sum of four original classroom variables; letter-sound interactions, time decoding without text, and two feedback measures ("repeats question" and "teacher leads"); with a substantial secondary contribution from Chunks, another additive sum of four classroom observation variables: whole word interactions, sentence reading interactions, sentence comprehension (text implicit) interactions, and the "repeats question" feedback variable. Other variables contributing to this composite are Time Decoding without Text and Seatwork; percent on Task, with nearly equal loadings in the upper .60's, and Feedback: Asks Explanation, which loads negatively (that is, asking for explanations seems to be an activity that diminishes, rather than enhances the teaching of decoding that is represented by the other variables contributing to this composite). Finally, the Task Management composite combines Seatwork: Percent on Task and the number of instances of Teacher Praise to Class.

Fall/winter performance tests. The kindergarten analyses were made more complex because the Chicago was given as a mid-year, rather than fall or spring, test. The other two of the three tests that seemed to have a consistent and meaningful relationship to other variables in the model, the Analogies test and the WRAT, appeared to be measuring two relatively independent aspects of cognitive functioning. Consequently, these measures were not combined to form a composite: all were treated simply as fallible measures of correlated but differentiable aspects of reading performance.

End-of-year achievement tests. The five measures retained from spring testing clustered into two overlapping composites, one of which we called Decoding Achievement and the other, Comprehension Achievement. The Reading scores from the CAT and SAT, were predominant on the Decoding composite, while the Woodcock was the major contributor to the Comprehension composite. The WRAT and Chicago contributed to both composites.

Structural Model Components

In this section, we describe how the several sets of variables are interrelated. As a reminder, the model we are presenting is not the only possible model for these interrelationships, but it is the one obtained when we applied the criteria and diagnostic/revision procedures described earlier in this part of the report. Overall, we were rather successful in modeling influences on the variation in end-of-year

achievement for both decoding and comprehension, accounting for about two-thirds of the variance in each composite variable. Although we did not have strong prior expectations about the pattern of structural relationships, we were somewhat surprised that only one antecedent variable--the WRAT--had a significant direct relationship to both Decoding and Comprehension.

Home-based variables. At this kindergarten level, the home environment variables affected both the more transitory home activity variables (represented in Home Support for Schooling and Home Instructional Activities) and the fall/winter achievement measures (Analogies, WRAT, and Chicago). Similarly, the home activity variables affected those same fall/winter test scores. Interestingly, all the effects of these home-based variables on end-of-year performance were indirect (mediated by the fall/winter tests) except the direct effect of home instructional activities on end-of-year comprehension achievement. Specifically, and too simply to be entirely accurate, the extent to which a kindergarten child was an active participant in reading activities in the home had a direct, positive effect on end-of-kindergarten performance on those measures clustered into a comprehension composite (primarily the Woodcock).

Of the variables representing relatively constant characteristics of the home background, the cluster incorporating parents' education and occupation made by far the largest contribution to beginning-of-year test performance, with structural coefficients of .53 for Analogies and .42 for WRAT scores. Surprisingly, this same composite was negatively related (-.27) to the Home Support for Schooling composite (Parental Support and Amount of Homework). Number of Siblings, whether younger or older, was also negatively related (-.14 for younger siblings, -.16 for older) to this Home Support composite, while number of younger siblings was positively associated with the Home Instructional Activities composite, albeit weakly (.09). The number of younger siblings a kindergarten child had contributed positively to performance on the beginning-of-year Analogies and middle-of-year WRAT tests (.11 and .07, respectively), while number of older siblings was negatively related to beginning-of-year performance on the WRAT. Finally, the more hours per week a child's mother worked, the lower the score on the WRAT, although this was also a rather weak relationship (-.15).

Predictably, performance on the beginning-of-year Analogies and WRAT was positively associated with mid-year performance on the Chicago, with the WRAT (.58) exhibiting a stronger relationship than did Analogies (.12).

Influences on end-of-kindergarten reading achievement. The ultimate goal of this research is to enhance our understanding of what factors in a child's world contribute to his or her becoming a proficient reader. A first step towards this explanation is to see how well we have been able, through the combination of entry-level skills, home environment, and classroom transactions, to account for performance on the two end-of-year composites: Decoding Achievement and Comprehension Achievement. Because the structure of relationships is so different for these two outcome variables, they are discussed separately.

Decoding achievement. The single best predictor of Decoding Achievement at the end of kindergarten was performance on the beginning-of-year administration of the WRAT (.58). The other beginning-of-year measure, the Analogies subtest, was also an important predictor (.26). Three classroom variables also contributed significantly to end-of-year decoding achievement: Activities Supporting Reading (.38), Word Comprehension Interactions (.14), and Task Management (-.20). The first two of these are easily understood: that such variables as time reading in text, numbers of background knowledge interactions and word comprehension interactions should have a positive effect on decoding achievement is quite reasonable. However, the third relationship is somewhat surprising: The more students in a classroom maintain their task involvement during independent seatwork and the more the teacher praises the class, the lower the performance on the decoding composite. Without a more specific understanding of what "seatwork" activities were and what kinds of "class praise" teachers were providing, this relationship must remain a puzzle. This model accounts for 66% of the variance in decoding achievement at the end of kindergarten.

Comprehension achievement. Two of the three tests given earlier in the year had moderate to strong relationships on end-of-year comprehension achievement: fall scores on the WRAT (.31), and mid-year performance on the Chicago (.56). Two other substantial positive influences on comprehension achievement were the Home Instruction Activities composite (.22) and the classroom composite labeled Teaching Decoding, which has both a direct influence (.20) and an indirect contribution (.14 x .56 = .08) through its effect on the mid-year Chicago scores. Finally, there is an inexplicable negative relationship (-.20) between end-of-year decoding achievement and comprehension achievement. Most simply, when all antecedent variables in the model (home background and support variables, previous test performance, and classroom behaviors) have been taken into account, students who perform well on the comprehension composite tend to be those who perform poorly on the decoding composite.

With this model, we have been able to account for 70% of the variance in comprehension achievement at the end of kindergarten, about 40% being attributable to the effects of entry-level skills (which in turn subsume indirect contributions from the "home environment" characteristics).

Noteworthy Features of the Kindergarten Model

The kindergarten model is, as one would expect, a fairly complex model of reading development. The beginning-of-year measures do not exhibit a cohesive structure and must be treated as individual variables in the model; relationships of home-based variables to end-of-year performance are nicely accounted for by the beginning- and middle-of-year performance measures as mediators. By far, the major predictor of end-of-year performance levels is beginning-of-year (or mid-year) performance.

Other features of this model that merit special mention are the influence of classroom behaviors--specifically the Teaching Decoding composite and Word Comprehension Interactions--on performance on the Chicago when that was administered at mid-year. This finding is encouraging, in that it suggests even at this early stage that the classroom variables chosen for recording in this study have relevance to student learning. It is also of some interest to note that there are two end-of-kindergarten performance composites: Decoding Achievement, for which the model explains 66% of the variance; and Comprehension Achievement, for which 70% of the variance has been explained by this model.

Discussion

This study was an effort to investigate individual differences in reading development in kindergarten. Toward that end, we began with a simple heuristic model that represented relationships between children's entry ability, home backgrounds, teachers' instructional characteristics, measures of ongoing support from home for literacy, and children's reading ability at the end of kindergarten. The results of the linear structural relations modeling suggest four topics for discussion. These topics will be presented sequentially as they appeared in the real lives of the children and families studied. The focus will center upon alterable variables, those characteristics that can be changed either by effort from parents or teachers.

First, the children's performance on the WRAT decoding subtest upon entering kindergarten directly affected their performance on both the decoding and comprehension composites at the end of the school year. The WRAT measures the ability of children to identify and match letters and then, dependent upon their success in this area, their ability to read a few words orally. This suggests that preschool preparation that focuses directly upon letter identification gives students the opportunity to learn to discriminate letter forms, a skill that is essential to learning how to read.

Second, once children enter kindergarten, we found that the practice they receive at home, the *participation* that they have in the reading process, has a direct relationship on their ability to read at the end of kindergarten. This finding suggests that, once in school, more passive activities such as parents reading to children have less effect upon their ability to read than active participation in reading

activities. It is quite likely that children receive long-term benefits from being read to. Some of these benefits may include the development of a love for reading, especially when in close contact with their parents or other adults. They may also derive substantial benefit from hearing the formal language of school as expressed in books. In addition, they may also develop vocabulary while being read to that gives a substantial boost to their overall vocabularies. Each of these is an important result of being read to, but they are quite different benefits form improving the children's reading abilities. This is a finding that suggests that parents should be encouraged to structure situations in which their children practice at home the reading they are learning at school independent of plans to continue reading to their children. Once children are themselves learning to read, these activities serve quite different purposes.

Third, activities in school that were found to make differences in children's abilities to read are those most directly related to the children's total reading process. The more time teachers spent on teaching letters and decoding without a text, for example, the better children did later when identifying words and comprehending what they meant. It is particularly important, we believe, to emphasize the direct relationship that we found between the constellation of activities that collectively we think of as "phonics instruction" and children's reading ability at the end of kindergarten. Children who were directly taught phonics word identification strategies read better than others. Teaching decoding directly affected comprehension achievement. Children who could identify words correctly also understood them.

Fourth, we have two latent variables at the end of kindergarten to describe the children's performance. We believe that it is important to explain, at least in part, why we believe the two constructs exist. We gave five tests at the end of kindergarten, which we thought of as the "reading battery." Two of these instruments (CAT and SAT) are group tests that simply require children to identify letters or words. These two tests correlated highly with each other, as one would expect, as they measure very similar things. To a lesser extent, the individually administered decoding subtest of the WRAT and the Chicago (which operates very similarly to the WRAT) joined the CAT and the SAT to form a composite. Given the high loadings of the SAT and CAT and the lesser loadings of the WRAT and Chicago, as well as the knowledge that these two tests also *begin with* letter identification tasks, suggests that we may in fact have a composite that represents children's abilities to identify letters and a few words. At this level, this letter and word identification ability is different from children's ability to understand what they read.

The second construct is made up only of individually administered instruments, the WRAT, Chicago, and Woodcock. This constellation even more accurately might be called Reading. It is heavily dominated by performance on the Woodcock where children have to be able to produce a few words on most items in order to complete the passage correctly with the cloze method. Most simply put, at the end of kindergarten level, it appears that if children can only discriminate letters and words they are doing something quite different from performing the more complicated job of identifying words and making sense of them.

We believe that further research that results in data-driven models that take into account measures from entering ability, classroom instruction, home background, and home support will help us to understand the complicated process of reading development.

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Table 1

Means and Standard Deviations of All Kindergarten Measures of Student Ability

Measure	Sample		Dist. A		Dist. B		Dist. C	
	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*
WRAT, FK	19.05	7.29	19.22	7.68	19.14	6.82	18.71	7.75
ANALOGIES, FK	5.45	2.78	4.68	2.54	5.84	2.54	5.58	3.26
CIRCUS, L, FK	17.26	4.03	16.66	3.96	17.81	3.55	16.92	4.79
CHICAGO, LFK	18.00	18.30	24.22	19.12	14.34	16.30	13.07	19.40
WRAT, SK	27.50	6.58	29.44	6.88	27.38	4.84	25.58	8.42
CHICAGO, SK	31.35	25.19	46.24	24.97	24.71	19.91	27.59	27.84
CAT, SK	17.66	4.21	18.71	3.92	18.03	3.65	15.80	4.93
SAT, SK	22.72	6.28	23.98	6.05	22.44	5.84	21.83	7.16
CIRCUS, L, SK	25.86	6.52	25.34	6.78	25.85	6.14	26.46	6.96
WOODCOCK, SK	2.34	3.61	3.46	4.76	1.74	2.77	2.23	3.31

Table 2

Means and Standard Deviations of All Kindergarten Measures of Classroom Process Variables

	Sample		Dist. A		Dist. B		Dist. C	
Measure	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*
Freq. of Interac:								
Letter Sds	19.72	18.82	48.03	7.67	10.24	7.72	6.51	2.99
Oral Rdg w/ Comp & FB	3.23	5.54	10.50	6.12	.28	.42	.86	1.05
Sding Out Wds	.14	.22	.32	.27	.00	.00	.22	.21
Background Know	1.96	2.85	5.58	3.07	.73	1.05	.32	.24
Word Comp	.10	.16	.19	.21	.00	.00	.17	.16
Encourages FB	.25	.29	.49	.27	.19	.27	.12	.15
Explanation FB	.04	.08	.10	.13	.02	.04	.00	.01
Minutes Spent:								
Decoding w/o text	.80	1.49	2.92	1.40	.00	.00	.00	.00
Rdg w/text	.99	2.13	3.58	2.70	.00	.00	.00	.00
Management Strat:								
% on task	81.28	5.05	87.42	.62	77.36	3.71	81.97	1.96
Sweeps/Yr	6.14	2.65	4.10	.92	5.28	1.70	10.06	.57
Praise to Ind	1.72	1.05	1.28	1.36	1.41	.55	2.80	.50
Praise to Class	.90	.78	1.23	.41	.35	.66	1.59	.51
Criticism (Ind & Class)	6.20	1.51	6.20	.81	5.23	.75	8.05	1.46

Table 3

Means and Standard Deviations of Measures of Parental Background

	Sample		Dist. A		Dist. B		Dist. C	
Measure	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*
Mother's Ed	3.70	1.13	3.37	.88	3.69	.96	4.25	1.56
Father's Ed	3.76	1.35	3.58	1.14	3.73	1.19	4.07	1.88
Mother's Occup	42.86	10.21	40.48	8.77	42.30	10.18	48.14	10.76
Father's Occup	44.12	13.70	41.60	11.35	43.15	13.38	50.78	16.02
Younger Sibs	.49	.62	.52	.61	.48	.62	.48	.66
Older Sibs	.98	1.13	.95	1.23	1.00	1.08	.95	1.14
# Adults Home	1.96	.45	1.89	.31	1.97	.38	2.04	.71
Hrs M Wks Wkly	20.21	18.13	18.20	18.95	20.55	18.18	22.47	16.68
Hrs F Wks Wkly	45.70	10.03	46.08	10.19	46.11	9.39	43.98	11.37

Table 4

Means and Standard Deviations of All Kindergarten Measures of Home Support for Literacy Development

	Sample		Dist. A		Dist. B		Dist. C	
Measure	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*
P rdg to C	11.19	3.38	11.19	3.09	10.91	3.36	11.91	3.80
C Participating	14.66	6.10	15.00	5.87	14.41	6.42	14.79	5.68
Parental Resources	112.52	26.25	108.10	21.43	112.83	24.13	118.41	35.52
Parental Support	1.43	.74	1.57	.63	1.50	.73	1.07	.84
Parental Instruc	2.51	1.16	2.58	1.13	2.37	1.20	2.73	1.07
Amt of Homework	1.30	.74	1.51	.61	1.26	.76	1.07	.81

Table 5

Correlations of Kindergarten Measures of Student Ability, Classroom Process Variables, and Home Support for Literacy Development

	Par Reads to Child	Child Prept in Reading	Parental Support	Par Instr Child	Amount Homework	WRAT PISK	Analogies	Chgo WISK	WRAT SP94	Chicago SP94	Calif Ach Test SP94	Stanf Ach Tst: SP94	Woodcock SP94	Mother's Education
Par Reads to Child	1.000													
Child Prept in Reading	0.241	1.000												
Parental Support	0.038	0.211	1.000											
Par Instr Child	0.290	0.587	0.182	1.000										
Amount Homework	0.102	0.308	0.600	0.176	1.000									
WRAT PISK	0.179	0.243	-0.055	0.173	-0.017	1.000								
Analogies	0.186	0.159	-0.019	0.173	-0.050	0.457	1.000							
CHGO WISK	0.202	0.324	-0.041	0.233	-0.029	0.617	0.408	1.000						
WRAT SP94	0.187	0.412	0.056	0.283	0.060	0.666	0.440	0.703	1.000					
Chicago SP94	0.182	0.303	-0.027	0.241	0.051	0.604	0.372	0.817	0.774	1.000				
Calif Ach Test SP94	0.108	0.196	0.017	0.124	0.064	0.559	0.471	0.585	0.597	0.621	1.000			
Stanf Ach Test SP94	0.128	0.289	-0.019	0.217	0.080	0.574	0.441	0.561	0.694	0.675	0.739	1.000		
Woodcock SP94	0.114	0.388	0.030	0.256	-0.021	0.501	0.279	0.588	0.719	0.632	0.385	0.406	1.000	
Mother's Education	0.236	0.668	-0.213	0.191	-0.140	0.363	0.415	0.357	0.289	0.183	0.143	0.197	0.172	1.000
Mother's Occupation	0.148	0.673	-0.091	0.077	-0.110	0.178	0.259	0.197	0.178	0.131	0.095	0.119	0.068	0.513
Father's Education	0.148	0.677	-0.120	0.130	-0.087	0.334	0.326	0.352	0.336	0.266	0.235	0.241	0.200	0.649
Father's Occupation	0.154	0.651	-0.195	0.041	-0.108	0.223	0.286	0.264	0.241	0.240	0.161	0.235	0.128	0.559
# Younger Siblings	0.056	0.089	-0.064	-0.007	0.031	0.043	0.068	0.128	0.050	0.106	0.032	0.051	0.138	-0.089
# Older Siblings	-0.163	-0.041	-0.088	-0.005	-0.164	-0.207	-0.184	-0.148	-0.075	-0.110	-0.179	-0.168	-0.014	-0.099
Hrs Mthr Works/Wk	-0.019	0.028	0.025	0.083	0.042	-0.073	0.054	-0.110	-0.089	-0.145	-0.101	-0.032	-0.133	0.105
Letters	-0.005	0.056	0.139	0.045	0.169	0.086	-0.157	0.169	0.176	0.313	0.148	0.169	0.176	-0.216
'Checks'	-0.013	0.110	0.114	0.054	0.126	0.184	-0.082	0.330	0.297	0.448	0.189	0.220	0.343	-0.186
Seatwork Pct on Task	0.064	0.043	0.074	0.069	0.142	0.029	-0.094	0.101	0.123	0.302	0.049	0.085	0.101	-0.082
Time Dead With Tst	0.005	-0.044	0.110	0.007	0.181	-0.143	-0.211	0.057	0.036	0.291	0.042	-0.036	0.043	-0.184
Hlnd Knwl Interactions	0.060	0.004	0.094	0.050	0.155	-0.017	-0.072	0.145	0.166	0.300	0.159	0.128	0.121	-0.170
Feedback subs Expl	0.000	-0.012	0.037	0.024	0.096	-0.073	0.036	0.048	0.071	0.169	0.124	0.081	0.082	-0.151
Time Reading in Text	0.033	0.018	0.051	0.008	0.141	-0.017	-0.051	0.150	0.138	0.284	0.195	0.158	0.180	-0.163
Pblic Tchr Encourages	-0.082	-0.085	0.083	-0.044	0.114	-0.042	0.021	0.014	0.040	0.066	0.074	0.013	-0.035	-0.073
Tchr Praise to Class	0.061	-0.004	-0.049	0.020	0.026	-0.060	-0.039	0.165	-0.032	0.137	-0.048	0.010	0.078	0.091
Sud Out Wd Nms	0.105	0.006	-0.005	0.052	0.104	-0.050	-0.078	0.157	0.028	0.238	0.006	0.057	0.083	-0.021
Wd Cmp Int'ns	0.093	0.004	0.038	0.060	0.137	0.107	-0.057	0.196	0.125	0.252	-0.018	0.108	0.155	0.004

Table 5 (Continued)

Mother's Occupat'n	Father's Education	Father's Occupat'n	# Younger Siblings	# Older Siblings	Hrs Mthr Works/Wk	Letters	'Chunks'	Seatwork Pct on Task	Time Dead with Tst	Signal Rand Intervalmss	Positive Asks Expl	Time Rdg in Text	Fdbk Tchr Encourages	Tchr Praise to Class	Std Out Wd Mean	Wd Comp Intrvs
1.000																
0.336	1.000															
0.220	0.636	1.000														
-0.116	-0.050	-0.083	1.000													
0.003	-0.041	0.000	-0.375	1.000												
0.110	-0.016	-0.087	-0.203	-0.035	1.000											
-0.188	-0.100	-0.136	0.010	0.020	-0.077	1.000										
-0.127	-0.042	-0.047	0.060	-0.010	-0.110	0.811	1.000									
-0.048	-0.002	-0.025	0.010	0.002	-0.076	0.763	0.640	1.000								
-0.142	-0.098	-0.130	0.021	-0.008	-0.036	0.805	0.536	0.659	1.000							
-0.095	-0.077	-0.137	0.049	-0.046	-0.075	0.668	0.453	0.654	0.761	1.000						
-0.059	-0.078	-0.160	0.067	-0.020	0.005	0.350	0.155	0.396	0.488	0.760	1.000					
-0.064	-0.068	-0.134	0.006	-0.005	-0.001	0.597	0.409	0.566	0.669	0.818	0.695	1.000				
-0.029	-0.009	-0.101	-0.006	0.005	0.024	0.403	0.214	0.469	0.510	0.574	0.545	0.620	1.000			
0.082	0.086	0.110	-0.028	0.019	-0.025	0.151	0.120	0.617	0.275	0.334	0.224	0.338	0.329	1.000		
0.086	-0.011	0.026	0.016	-0.063	0.020	0.317	0.200	0.573	0.587	0.579	0.463	0.667	0.301	0.575	1.000	
0.002	0.052	0.058	0.055	-0.122	-0.084	0.308	0.386	0.568	0.272	0.383	0.124	0.188	0.035	0.262	0.367	1.000

Figure 1

HEURISTIC MODEL

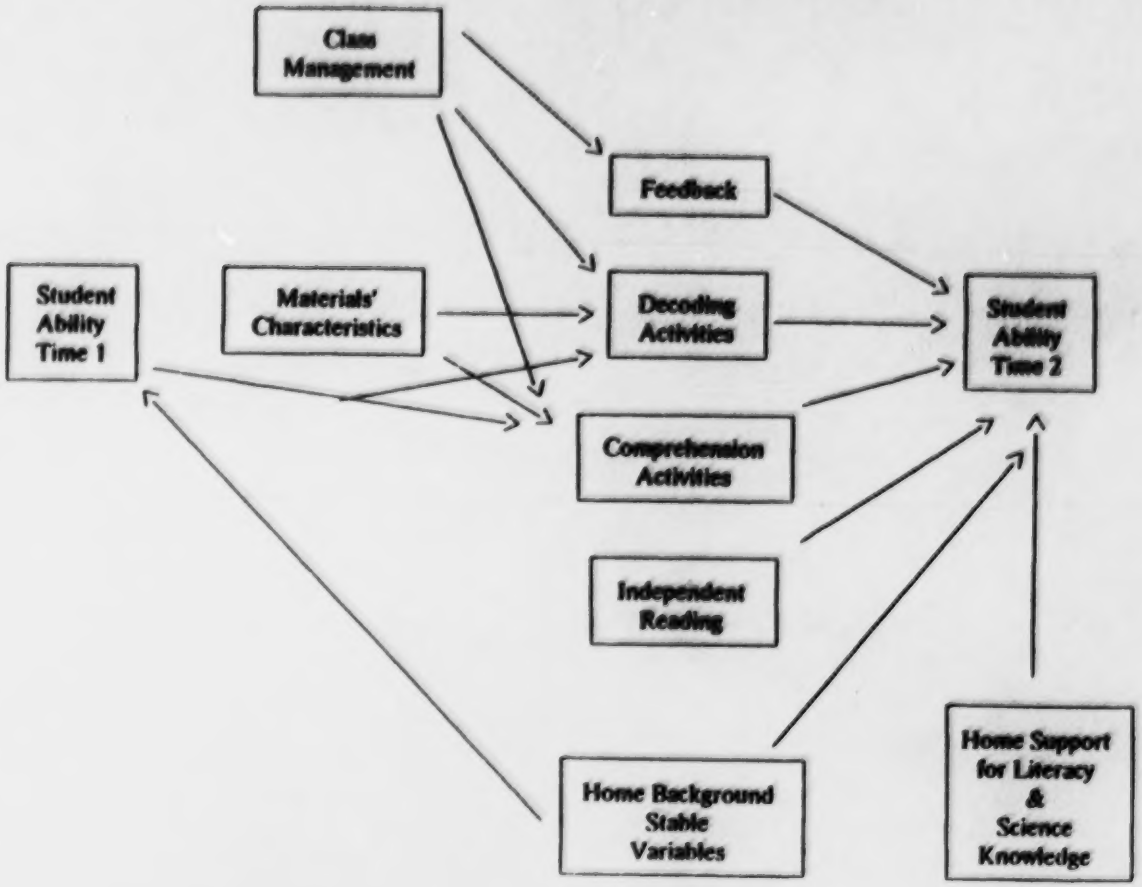


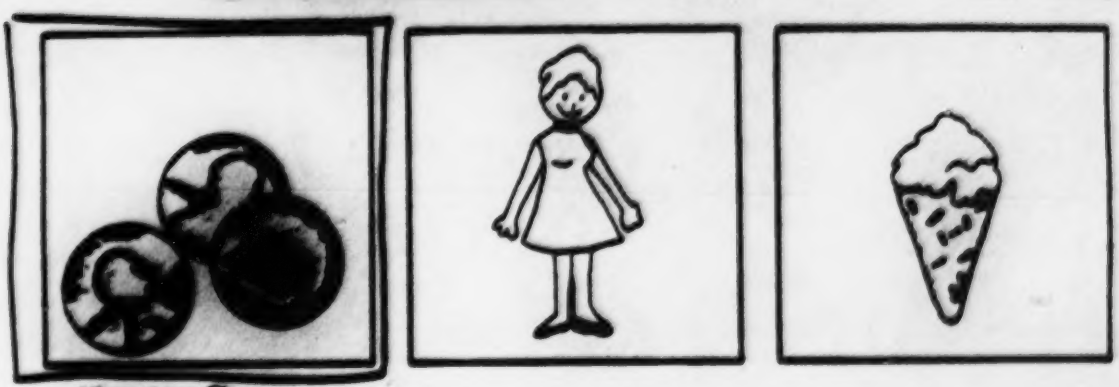
Figure 2

Comprehension Item from the CIRCUS Listening Test

2

Look at these pictures and listen carefully. The teacher said,
"Save your pennies so you can buy ice cream at the circus."

Mark what she told them to save.



Allow time. Then say:

Now turn the page.

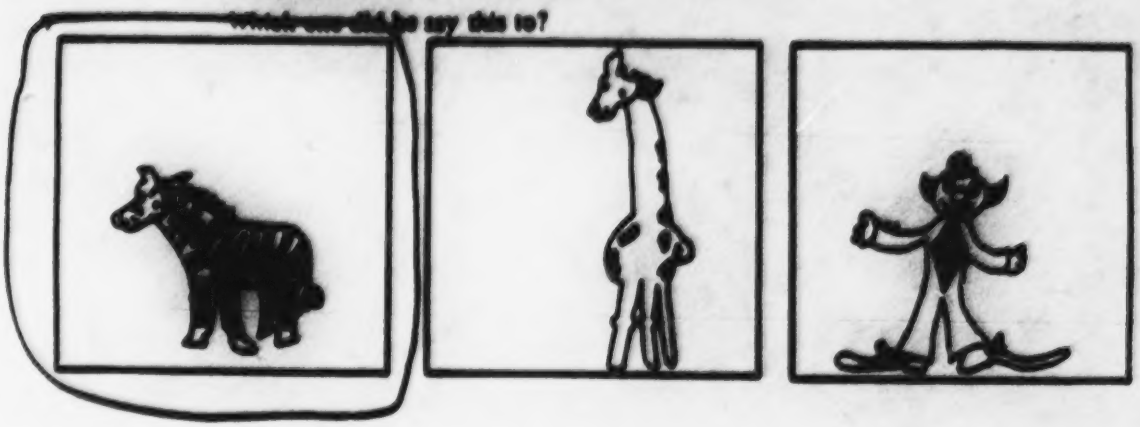
Figure 3

Interpretation Item from the CIRCUS Listening Test

18

Clarence Clown wasn't always polite. The children heard him tell one of the animals to go take off his silly striped pajamas.

Which one did he say this to?



Turn the page.

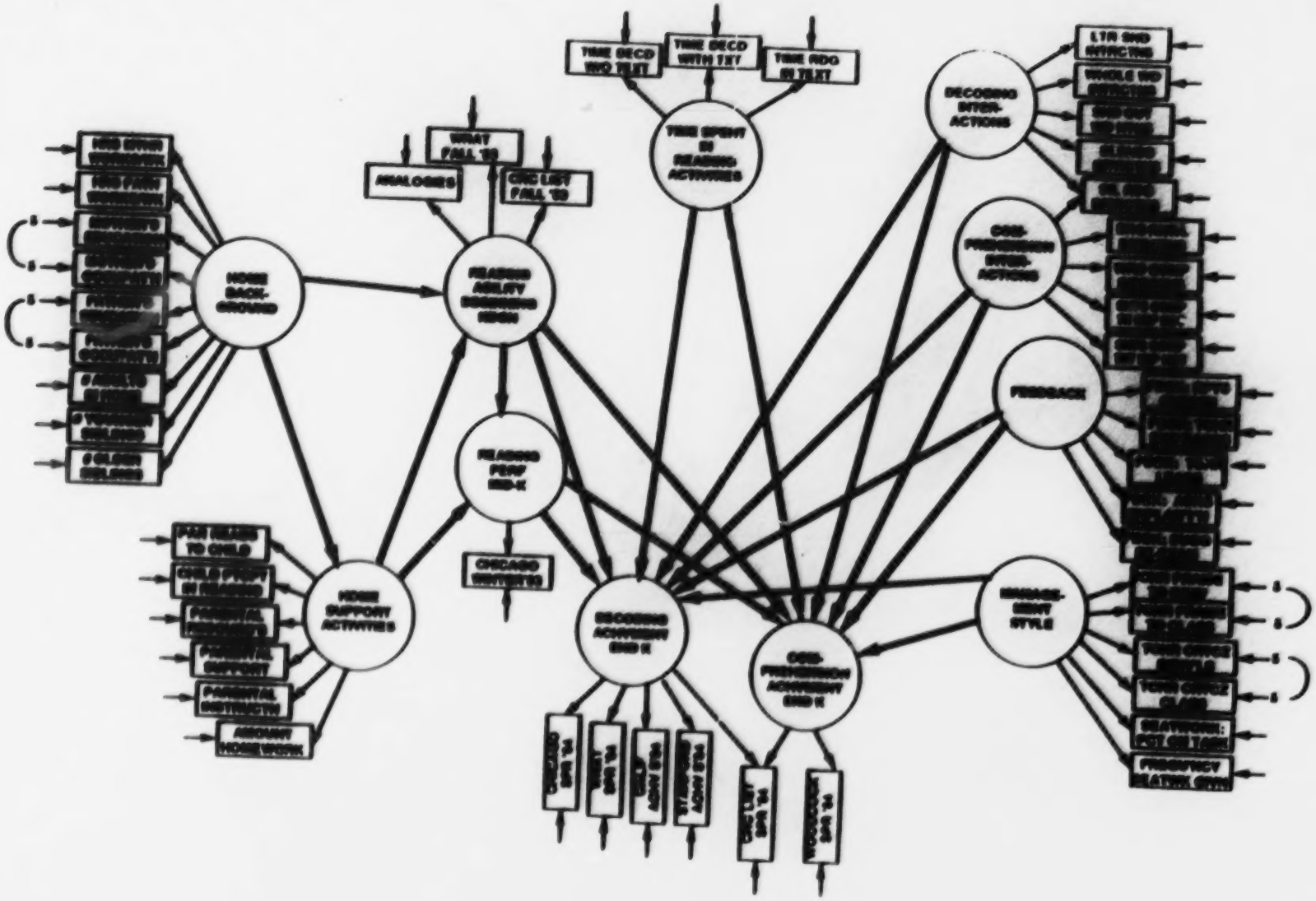


Figure 4 Initial Structural Model for Kindergarten Reading

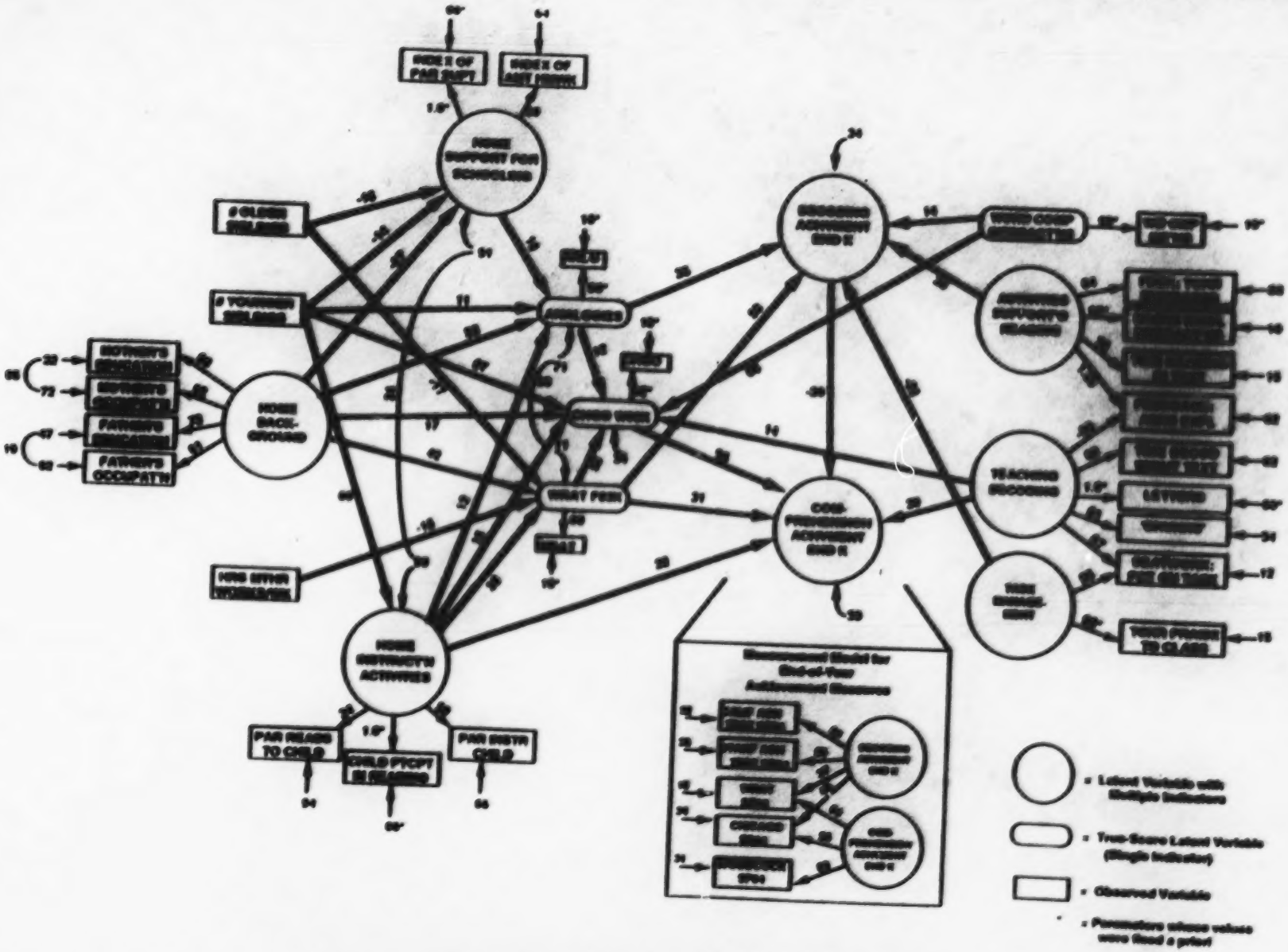


Figure 5 Final Structural Model for Kindergarten Reading